vation the time stamp of the last liftoff by the old path must be preserved for comparison with the time stamp of the new touchdown.

[0283] If all of these tests are passed, step **758** looks up the current path position ($P_x[n]$, $P_y[n]$), and step **760** finds the key region whose reference position is closest to the fingertip centroid. Decision diamond **762** checks that the nearest region is within a reasonable distance of the finger, and if not causes the finger press to be ignored. Assuming a key region is close to the finger, step **764** creates a keypress element data structure containing the path, index identifier and finger identity, the closest key region, and a time stamp indicating when the finger crossed the keypress proximity threshold. Step **766** then appends this element data structure to the tail of a FIFO keypress queue. This accomplished, processing returns to step **750** to process or wait for touchdowns by other fingers.

[0284] The keypress queue effectively orders finger touchdowns by when they pass the keypress transmitted to the host. However, an element's key symbol is not assured transmission of the host once in the keypress queue. Any of a number of conditions such as being part of a synchronized subset of pressing fingers can cause it to be deleted from the queue before being transmitted to the host. In this sense the keypress queue should be considered a keypress candidate queue. Unlike the ordered lists of finger touchdowns and releases maintained for each hand separately in the synchronization detector, the keypress queue includes and orders the finger touchdowns from both hands.

[0285] FIG. **43**A shows the steps within the keypress acceptance and transmission loop. Step **770** picks the element at the head of the keypress queue, which represents the oldest finger touchdown which has neither been deleted from the queue as an invalid keypress candidate nor transmitted its associated key symbol. Decision diamond **772** checks whether the path is still identified as a finger. While waiting in the queue path proximity could have increased so much that the identification system decides the path is actually from a palm heel, in which case step **778** deletes the keypress element without transmitting to the host and step **770** advances processing to the next element. Decision diamond **774** also invalidates the element if its press happened synchronously with other fingers of the same hand. Thus decision diamond **774** follows through on deletion command steps **601**, **612**, **615**, **620** of the synchronization detection process (FIG. **39**). Decision diamond **776** invalidates the keypress if too much lateral finger motion has occurred since touchdown, even if that lateral finger motion has not yet caused a chord slide to start. Because users may be touch typing on the surface, several millimeters of lateral motion are allowed to accommodate glancing fingertip motions which often occur when quickly reaching for keys. This is much more glancing tap motion than is tolerated by touchpads which employ a single finger slide for mouse cursor manipulation and a single finger tap for key or mouse button click emulation.

[0286] Decision diamond **780** checks whether the finger whose touchdown created the keypress element has since lifted off the surface. If so, decision diamond **782** checks whether it was lifted off soon enough to qualify as a normal key tap. If so, step **784** transmits the associated key symbol to the host and step **778** deletes it from the head of the queue. Note that a keypress is always deleted from the queue upon liftoff, but even though it may have stayed on the surface for a time exceeding the tap timeout, it may have still caused transmission as a modifier key, as an impulsive press with hand resting, or as a typematic press, as described below.

[0287] When a keypress is transmitted to the host it is advantageous for a sound generation device on the multi-touch surface apparatus or host computer to emit an audible click or beep as feedback to the user. Generation of audible click and beep feedback in response to keypresses is well known in commercial touchscreens, kiosks, appliance control panels and mechanical keyboards in which the keyswitch action is nearly silent and does not have a make force threshold which feels distinctive to the user. Feedback can also be provided as a light on the multi-touch surface apparatus which flashes each time a keypress is sent. Keypresses accompanied by modifier keypresses should cause longer flashes or tones to acknowledge that the key symbol includes modifiers.

[0288] If the finger has not yet lifted, decision diamond **786** checks whether its associated key region is a modifier such as <shift>, <ctrl>, or <alt>. If so, step **788** advances to the next element in the queue without deleting the head. Processing will continue at step **772** to see if the next element is a valid key tap. If the next element successfully reaches the transmission stage, step **784** will scan back toward the head of the queue for any modifier regions which are still pressed. Then step **784** can send the next element's key symbol along with the modifying symbols of any preceding modifier regions.

[0289] Decision diamond **782** requires that users touch the finger on the surface and lift back off within a few hundred milliseconds for a key to be sent. This liftoff timing requirement substitutes for the force activation threshold of mechanical keyswitches. Like the force threshold of mechanical keyswitches, the timing constraint provides a way for the user to rest the finger on the key surface without invoking a keypress. The synchronization detector **14** provides another way forefingers to rest on the surface without generating key symbols: they must touch down at the same time as at least one other finger. However, sometimes users will start resting by simultaneously placing the central fingertips on the surface, but then they follow asynchronously with the pinky a second later and the thumb a second after that. These latter presses are essentially asynchronous and will not be invalidated by the synchronization detector, but as long as they are not lifted within a couple hundred milliseconds, decision diamond **782** will delete them without transmission. But, while decision diamond **782** provides tolerance of asynchronous finger resting, its requirement that fingers quickly lift off, i.e., crisply tap, the surface to cause key generation makes it very difficult to keep most of the fingers resting on the surface to support the hands while tapping long sequences of symbols. This causes users to raise their hands off the surface and float them above the surface during fast typing sequences. This is acceptable typing posture except that the users arms will eventually tire if the user fails to rest the hands back on the surface between sequences.

[0290] To provide an alternative typing posture which does not encourage suspension of the hands above the surface, decision diamond **790** enables a second key acceptance mode which does not require quick finger liftoff after each press. Instead, the user must start with all five fingers of a hand resting on the surface. Then each time a finger is asynchronously raised off the surface and pressed on a key region, that key region will be transmitted regardless of subsequent liftoff timing. If the surface is hard such that fingertip proximity quickly saturates as force is applied, decision diamond **792**